HEAT EXCHANGER

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a heat exchanger mounted on an air conditioning device and the like.

Description of the Related Art

Fig. 9 shows an example of a two-block heat exchanger used as an evaporator in an automobile air conditioning system and the like. The heat exchanger shown in the figure is referred to as a drawn cup type, and is formed by plate-shaped refrigerant distribution parts 3 comprising overlapping rectangular plates 1 and 2 that have had a drawing process carried out thereon and cooling fins 4 bent into an wave shape being alternately layered.-+

In the refrigerant distribution parts 3, the periphery and center of the plates 1 and 2 are brazed, and thereby a U-shaped refrigerant path R is formed that goes from the refrigerant entrance 5 provided at the top, descending to and returning from the bottom for discharge into the refrigerant exit 6 provided at the top and arranged next to the refrigerant entrance.

In this heat exchanger, the refrigerant is distributed among each of the refrigerant distribution parts 3 in the refrigerant entrance 5, is evaporated in the process of flowing through in the refrigerant paths R, merges together again in the refrigerant exit 6, and flows out of the heat exchanger.

However, problems such as the following can be pointed out concerning the heat exchanger having the structure described above.

Specifically, as shown in Fig. 10, a continuous space T (below referred to as a tank) is formed by the layering of refrigerant entrances 5, and the refrigerant flowing into the heat exchanger is distributed to each of the refrigerant distribution parts 3 in the process of progressing through this continuous space in the direction of the arrows in the figure. However, in the conventional heat exchanger, the refrigerant supplied to the tank T passes with difficulty to the back of the tank T and there is a tendency for much of the refrigerant to flow through the upstream side of the refrigerant paths R. Thus, the flow of the refrigerant stagnates in the downstream side of the tank T. Due to this, the distribution of refrigerant to each of the refrigerant distribution parts 3 cannot be carried out uniformly, and at the refrigerant path R of the tank T positioned downstream, the refrigerant becomes hot, and the heat exchange cannot be sufficiently carried out.

In consideration of the problem described above, it is an object of the present invention to provide a heat exchanger that can realize an improvement in the heat exchange capacity by evenly distributing the refrigerant in the refrigerant paths.

SUMMARY OF THE INVENTION

A first aspect of the present invention is characterized in a heat exchanger being a two-block heat exchanger formed by a plate shaped refrigerant distribution part having overlapped two plates that have been drawing processed and providing a refrigerant path inside alternatively layered with a refrigerant fin, openings that open into the refrigerant paths formed respectively in each of the two plates, and a continuous refrigerant circulation space formed by abutting the openings of the adjacent refrigerant distribution part that are layered, wherein: the refrigerant distribution part provides two separate

refrigerant paths through which the refrigerant flows and the openings provided at both respective ends of these refrigerant paths; and one end of each of the refrigerant circulating spaces is a closed end that is closed off and the other end is an open end that is opened, and among the two refrigerant paths, the open end of the refrigerant circulation space formed by the one open part of the one refrigerant path is connected to the open end of the refrigerant circulation space formed by the one open part of the other refrigerant path.

In the present invention, in the two-block heat exchanger in which each refrigerant distribution part has a two-row refrigerant path, once the refrigerant that flows through one of the refrigerant paths flows out into the refrigerant circulation space, subsequently, it flows through the other refrigerant path. In this manner, because the refrigerant flows though each of the two refrigerant paths, the stagnation of the refrigerant is prevented, and heating occurs with difficulty.

In a second aspect of the present invention, a heat exchanger according to the first aspect has a refrigerant distribution means that adjusts the amount of refrigerant supplied to the refrigerant path provided on at least one of the refrigerant circulation spaces.

In this heat exchanger, because the amount of refrigerant flowing into each refrigerant path is controlled by the refrigerant distribution means, the uniformity is further improved.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective drawing showing an embodiment of the heat exchanger according to the present invention.

Fig. 2 is a perspective drawing viewing the same heat exchanger from the back.

Fig. 3 is an exploded perspective drawing showing the refrigerant distribution part that forms the heat exchanger in Fig. 1.

Fig. 4 is a cross-sectional drawing showing the space at the entrance side and the refrigerant path connected thereto.

Fig. 5 is a cross-sectional drawing showing the space at the exit side and the refrigerant path connected thereto.

Fig. 6 is a drawing showing an embodiment similar to this same heat exchanger, and is a time sequence drawing formed at each baffle plate.

Fig. 7 is a modification of the present invention, and is a cross-sectional drawing showing the space at the entrance side and the refrigerant path connected thereto.

Fig. 8 is a perspective drawing viewing the heat exchanger shown as a modification of the present invention form the back.

Fig. 9 is a perspective drawing showing an example of the conventional evaporator.

Fig. 10 is a cross-sectional drawing showing the space the entrance side and the refrigerant path connected thereto in a conventional evaporator.

DETAILED DESCRIPTION OF THE INVENTION

Next, the preferred embodiments of the present invention will be explained referring to the figures.

The heat exchanger shown in Fig. 1 is formed by a plate shaped refrigerant distribution part 11 and a wave shaped refrigerant fin 12 being alternatively layered. Fig. 2 is a perspective drawing of the heat exchanger seen from the back side.

As also shown in Fig. 5, the refrigerant distribution part 11 comprises substantially rectangular plates 13 and 14, which have been drawing processed, being layered and brazed at the periphery and center. In the refrigerant distribution part 11, independent refrigerant paths R1 and R2 through which the refrigerant flows are provided next to each other. In the lower part, the refrigerant entrance 15a and the refrigerant exit 16b of the refrigerant paths R1 and R2 are provided next to each other. In the upper part, refrigerant exit 15b and refrigerant entrance 16a of the respective refrigerant paths R1 and R2 are provided next to each other.

In the refrigerant distribution part 11, the plates 13 and 14 that form the refrigerant paths R1 and R2 are recessed from the outside to form a plurality of dimples 17, and a plurality of bulge parts 18 are formed in the refrigerant paths R1 and R2 by these dimples 17. Moreover, inner fins can be sandwiched between the plates 13 and 14 to form the refrigerant paths R1 and R2 as well.

As shown in Fig. 3, the refrigerant entrance 15a comprises openings 13-1a and 14-1a formed in the plates 13 and 14, and as shown in Fig. 4, the refrigerant entrances 15a provided on each of the refrigerant distribution parts 11 form a continuous space Sin 1 (the refrigerant circulation space) on the entrance side by abutting without sandwiching the refrigerant fin 12. Similarly, the refrigerant exit 15b comprises openings 13-1b and 14-1b formed in the plates 13 and 14, and as shown in Fig. 5, the refrigerant exit 15b provided on each of the refrigerant distribution parts 11 forms a continuous space Sout 1 (refrigerant circulation space) on the exit side by abutting without sandwiching the refrigerant fin 12.

Although not illustrated, similarly, the refrigerant entrance 16a comprises the openings 13-2a and 14-2a formed in the plates 13 and 14 and forms the space Sin 2 (the refrigerant circulation space) on the entrance side, and the refrigerant exit 16b comprises

the openings 13-2b and 14-2b formed in plates 13 and 14, and forms the space Sout 2 (refrigerant circulation space) on the exit side (refer to Fig. 1).

Specifically, in the refrigerant distribution part 11, the space Sin 1 on the entrance side and the space Sout 2 on the exit side are respectively positioned adjacent to the space Sout 1 on the exit side and space Sin 2 on the exit side. In addition, as shown in Fig. 1, one end of the space Sout 1 on the exit side and space Sin 2 on the entrance side is closed off, and the other end shown in Fig. 2 is connected by the communicating path 30.

In the heat exchanger having the structure described above, the refrigerant is distributed in each of the refrigerant distribution parts 11 by the process of progressing through the space Sin 1 on the entrance side in the direction of the arrow shown in the figure, is evaporated by the process of flowing through each of the refrigerant paths R1, and merged in the space Sout 1 on the exit side. Next, passing through the communicating path 30, the refrigerant progresses through the space Sin 2 on the entrance side in the direction opposite to that of the space Sout 1 on the exit side, and by this process, the refrigerant is distributed to each of the refrigerant distribution parts 11, further evaporated by a process of flowing through each of the refrigerant paths R2, and again merges and flows into the space Sout on 2 the exit side.

However, as can be understood from Fig. 3, the opening 13-1a in the plate 13 that forms the refrigerant entrance 15a is formed smaller than the opening 14-1a of the plate 14 that similarly acts as the refrigerant entrance 15a. Further, as shown in Fig. 4, an opening 14-1a is formed at the same position in each of the refrigerant distribution paths 11, but the openings 13-1a are formed at respectively differing positions in each of the refrigerant distribution parts 11. This means that because the refrigerant distribution part 11 is layered, the part that forms the opening 13-1a provides a function as an baffle

plate (a cooling distribution means) that prevents flow of the refrigerant to the opening 14-1a forming the refrigerant entrance 15a, and the opening 13-1a is provided on the adjacent baffle plate 20 and disposed so as not to overlap in the direction of flow of the refrigerant.

Moreover, although omitted in the figures, the opening 14-2a of the plate 14 forming the refrigerant entrance 16a is structured similarly (refer to Fig. 3). Below, the space Sin 1 on the entrance side will be explained, but the explanation is similar for the space Sin 2 on the entrance side as well.

In this heat exchanger, the refrigerant that flows through the space Sin 1 on the entrance side flows downstream while passing through the openings 13-1a formed by each of the baffle plates 20, and the refrigerant that cannot pass through the opening 13-1a is guided by the baffle plates 20 to flow into the refrigerant path R1.

Furthermore, because the opening 13-1a is disposed so as not to overlap the adjacent baffle plates 20 that are provided, a part of the refrigerant that passes, for example, through the opening 13-1a of the baffle plate 20a on the upstream side cannot pass through the opening 13-1a because the flow is blocked by the baffle plate 20b when flowing through the opening 13-1a of the adjacent baffle plate 20b.

In this manner, because the opening 13-1a provided in the adjacent baffle plate 20 is disposed so as not to overlap each other, much refrigerant is distributed to the refrigerant distribution part 11, where refrigerant tended to stagnate, and each of the refrigerant distribution parts 11 provided in plurality can distribute the refrigerant uniformly.

Moreover, the number of openings 13-1a formed in each baffle plate 20 is not limited to one, but for example, as shown in Fig. 6, may be provided in plurality, and

furthermore, the size of each of the openings 13-1a can be respectively formed so as to be different.

In addition, the baffle plates 20 can also be provided on the plate 14 side.

Furthermore, baffle plates 20 do not need to be formed on all of the plates 13 (14), and only need to be provided on one among the spaces Sin 1 and Sin 2 on the entrance side.

Moreover, as an example of a modification, the structure described below is possible. Moreover, in the following as well, only the space Sin 1 on the entrance side will be explained, but the explanation for the space Sin 2on the entrance side is similar.

In the heat exchanger in the present example, as shown in Fig. 7, the opening 13-1a is formed as small as the baffle plate 21 positioned in the direction of flow of the refrigerant. For example, the part of the refrigerant that passes through the opening 13-1a of the baffle plate 21a on the upstream side cannot pass through the opening 13-1a because the flow is prevented by the baffle plate 21b when passing through the opening 13-1a of the adjacent baffle plate 21b in the downstream direction.

In this manner, because the openings 13-1a are formed increasingly smaller in the baffle plates 21 positioned further in the direction of flow of the refrigerant, the refrigerant can be distributed uniformly by all of the refrigerant distribution parts 11 provided in plurality.

In this manner, in the heat exchanger of the present example, the refrigerant flows through one side of the two refrigerant paths R1 and R2, and thus heating due to the stagnation of the refrigerant is prevented.

In addition, in the spaces Sin 1 and Sin 2 on the entrance side, even if the flow of the ow of the refrigerant is reversed, the heat is dissipated because of the refrigerant flowing through the space Sin 2 of the entrance side.

Furthermore, the refrigerant can be distributed more evenly in the refrigerant distribution part 11 because the refrigerant is distributed by the baffle plates 20 (21).

Moreover, as shown in Fig. 8, because the spaces Sin 1 and Sin 2 on the entrance side and the spaces Sout 1 and Sout 2 on the exit side are positioned adjacently to each other, the space Sout 1 on the exit side and space Sin 2 on the entrance side can be connected by the communicating path 30'.

As explained above, in the present invention, because the refrigerant flows through each of the sides in the refrigerant path, heating due to the stagnation of the refrigerant is prevented.

In addition, by providing a refrigerant distribution means, the refrigerant can be distributed more evenly.